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The Cleveland Convention Papers—I

The outstanding feature of the Papers presented to the Cleveland Convention of the American Foundrymen's Association is the large number devoted to ancillary, but still crucial aspects of foundry practice. Included amongst these are two on patternmaking, two on welding and one each on carbon determination; statistical methods of control; design of castings; pyrometry; fettling; time study; and grinding wheel costs.

Of the two patternmaking Papers, an interesting contribution is made by Mr. E. T. Kindt, who brings out the important point that a modern well-heated patternshop may dry out the timber from, say, 12 to 7 per cent. superficially, and patterns and coreboxes made therefrom will be later in contact with damp sand, pick up moisture, and expand to such an extent that deformation will ensue. His remedy is control through the regular use of a moisture meter. The second Paper on patternmaking is by Mr. A. K. Laukel and strikes a distinctly novel note. After a short dissertation on corrosion of pattern equipment, due to the contact of dissimilar metals, the author deals with copper-plated patterns. The plastic mixture recommended is three pounds of a good grade of dental plaster mixed with one quart of water. The plaster is added to the water, allowed to stand for a few minutes, stirred and then poured. The setting time is about 20 minutes; the expansion 0.0019 in. per ft. when cold. Before plating, the plaster moulds are oven dried at 140 deg. F. This reduces the weight by 35 per cent. and a moisture meter is used for control. The moulds are then waxed, allowed to cool and made conductive by suitable means, such as graphite or metal powders. The plating is carried out in still tanks, usually from three to six days, whilst a tank temperature of 80 deg. F. is maintained. The minimum thickness is of the order of $\frac{1}{32}$ of an inch, but to ensure this some parts may be $\frac{1}{8}$ of an inch or more. When the deposits are finished they are removed from the mould, hot tinned and backed up with white metal, and brass strips are added internally. The brass strips are useful for both reinforcing and for taking screws and dowels. These copper patterns are said to wear equally as well as cast iron, but obviously are heavier than aluminium. The Paper contains some useful points on the repair of patterns and coreboxes by copper-plating.

This Convention being a Western Hemisphere Congress, it naturally included Papers from other American countries. Dr. Ernest Geiger, of Brazil, contributed one of a type which we usually associate with German technical schools. He dealt with designing for foundry production, and used the "this is right and this is wrong" method of presentation. We have yet to be convinced that this is the ideal system but its usefulness in the present state of the art of foundry practice is unquestioned.

Mr. J. G. Donaldson has described a new rapid (fifteen minutes) and accurate method for the determination of carbon in cast iron and steel, which is worth study by the laboratory staffs. A very important Paper was read by Mr. H. H. Fairfield, of Ottawa, on "Statistical Methods as an Aid to the Control of Foundry Operations." It covers, though with specialised application, some of the ground disclosed by the recent symposium on the subject held in London, and reinforced by additional meetings in the provinces. Only recently we dealt with the subject editorially. Another important Paper of an entirely different character deals with the continuous recording of metal temperatures by the "Rayotube" instrument. The contribution was made by Mr. R. H. Koch and Mr. A. E. Schuh. A closed refractory tube of clay graphite, which lasts three 16-hr. heats, is immersed so as to be surrounded by the molten iron. At the other ends there is a

(*Concluded overleaf.*)

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THE CLEVELAND CONVENTION PAPERS—I

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thermopile which gives continuous readings. Much useful data should become available by the use of this instrument.

Useful information is disclosed as to potential savings in the fettling shop by a Paper from Mr. Howard B. Nye, which covers pneumatic and airless shot-blast cleaning and tumbling barrels and by one on grinding wheel cost control, by J. A. Westover, which reveals a bonus system payable to the operator on wheel economy. The salvaging of aluminium alloy castings by welding was dealt with in a Paper by Mr. A. T. Ruppe and Mr. A. J. Juroff. The main part of the discussion relates to the testing of deposited weld metal, but this is amplified by examples of successfully salvaged castings. A somewhat similar Paper, but more practical, from Mr. S. E. Mueller, Mr. A. B. Smith and Mr. J. F. Oesterle, deals with the welding of both plain and alloyed steel castings by the carbon arc process. The final Paper entering into this group is one on the use of job evaluation in the application of time study, by Mr. E. L. Berry and Mr. E. A. Berg. It resembles, to some small degree, Lord Woolton's food rationing points scheme, the points being based on eleven factors: Education; experience; initiative and ingenuity; physical demand; mental or visual demand; responsibility for equipment or process; responsibility for material or product; responsibility for safety of others; responsibility for work of others; working conditions; and unavoidable hazards. By a system of division into five degress, points are assigned to each factor, a chart showing the day rates ranging from a labourer to a patternmaker, with parallel bands for minimum, average and maximum hourly rates and incentive rate, has been prepared. As an effort to establish fairness in the payment of wages, the system has much to commend it. It will be readily granted from the above, that these ten Papers, representing less than a quarter of the total number presented, are worth-while efforts and clearly demonstrate how useful the great technical institutes can be to a nation's war effort. In the near future we shall cover the balance of the Papers, which are devoted to cast iron, steel castings, sand and non-ferrous practice.

KAISER COMPANY, INC., Oakland, Calif., is building a new iron and steel plant on the Pacific Coast, with a 1,200-ton blast furnace, four open-hearth furnaces, and a 110-in. sheared plate mill. Iron ore analysing over 60 per cent. Fe, and limestone and coke will be obtained from points near the new plant.

DIRECT MEASUREMENT OF CORROSION RATE

To study the mechanism of metal oxidation and its rate, Dr. Earl A. Gulbransen, of the Westinghouse Research Laboratories, Pittsburgh, is weighing films of rust, with a weighing machine weighing down to 10^{-8} ozs. The weighing machine is sealed in a glass tube to take measurements on pieces of metal half the size of a razor blade. Movements of the balance's pointer are observed through a microscope and reveal the weight added to a tiny sample of steel by a single layer of oxygen atoms. The balance, about 6 in. long and 1 in. sq., is enclosed in one arm of a glass tube the shape of a cross, 3 ft. tall and 2 ft. wide. The moving arm of the balance is a piece of quartz 6 in. long and $\frac{1}{16}$ in. in diameter. It is supported at the middle by a fine piece of tungsten wire which is stretched across a framework made of quartz. From one end of the moving beam the sample piece of steel is suspended on a 2-ft. piece of tungsten wire inside the vertical part of the glass tube. A counterweight, with the same weight as the sample, is hung on the other end of the beam.

The sample is polished and washed three times in alcohol before it is placed in the tube, but the brief contact with air is enough to form several layers of oxide. The tube is sealed and the air is removed by two vacuum pumps. Final cleaning is done with hydrogen. A small amount of the gas is piped into the tube from a pressure tank. The hydrogen combines with the oxygen on the surface of the sample to form free water vapour, which is then pumped out of the tube. To start the experiment, a small amount of oxygen is admitted to the tube from another tank. The sample gets heavier, as the oxygen combines with the surface layers of the steel, swiftly at first and then slowly. Movement of the balance is watched through the microscope, and the changes in weight are recorded every few minutes.

INSTITUTE OF BRITISH FOUNDRYMEN

NOTES FROM THE BRANCHES

London Branch.—The session is being resumed on Thursday, August 27, at 7.30 p.m., at the National Liberal Club, when Mr. J. H. Williams, B.Sc., will open a discussion on "Ladle Metallurgy."

The Nickel Bulletin.—The July issue of the "Nickel Bulletin" contains abstracts dealing with nickel recovery from scrap, tensile elastic properties of stainless steel, micro-straining in water purification, creep rates of Monel, properties of nickel-copper-chromium cast irons, spark testing of steels, and welding and surface hardening of stainless steel. Tabulated data on standard brass and bronze alloys are included. Copies may be obtained, free of charge, from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

ARMASTEEL—ITS MANUFACTURE, CONTROL AND APPLICATIONS

American Foundrymen's Association Exchange Paper read at the recent annual conference of The Institute of British Foundrymen

By CARL F. JOSEPH *

The malleable iron industry is quite frequently referred to as one of the backward industries. Over a period of years, the number of plants producing malleable castings has decreased from 175 to the present of approximately 100. Likewise, the tonnage has dropped from 901,000 tons in 1925, with a Federal Reserve Index of Industrial Production of 104, to 565,000 tons in 1939, with an Index of 106.

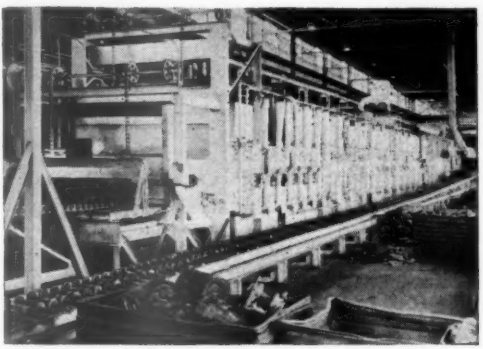

FIG. 1.—ATMOSPHERE-CONTROLLED RADIANT-TUBE GAS-FIRED CONTINUOUS ROLLER RAIL HEAT-TREATING FURNACE.

This is not a healthy condition for any industry in which to find itself, and upon further investigation the reason is quite readily apparent. The industry, as a whole, has not kept pace with the scientific development of the other iron and steel industries. However, some of the larger units in the industry during the past decade have made use of much of the technical knowledge available, and rapid progress in all branches of the industry has been made. This has resulted in regaining some of its tonnage, and due to more intensive research and development work, better technical control in all phases of the manufacture of castings has been accomplished, resulting in a better and more uniform product.

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National Defence

During 1942, this country will be short some twenty-five million tons of steel. In the interest of national defence it has become increasingly important to reclassify many automotive, refrigerator, tank, machine gun and other parts in order to have sufficient steel and non-ferrous metals to go into those parts which do not offer any replacement possibilities. The question of the

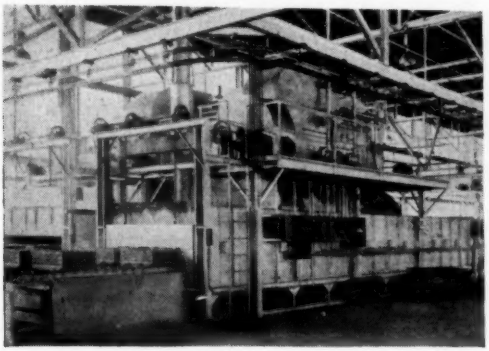


FIG. 2.—ROLLER RAIL RECIRCULATING DRAW FURNACES FOR ARMASTEEL.

proper material to be used to replace many steels, bronzes and aluminium parts is uppermost in the minds of many engineers.

Castings versus Forgings

In recent years there has been a tendency in the motor vehicle field to replace certain forgings with castings. This has gradually followed through in other industries. Many engineers are inclined to put aside the marked improvement in metallurgy as applied to foundry operations which has developed in the past decade. Constant pressure is being brought by the engineers to reduce weight, increase physical properties and cut manufacturing costs. The desire to increase the use of castings has caused the foundryman to venture into hitherto unexploited fields in order to find new

uses which have often been considered outside of the range of practical accomplishment.

Selection of Material

The proper material to select for any given purpose is that which will perform the required service at the lowest ultimate cost, provided it can be obtained in the necessary quantity. Intelligent selection and utilisation of materials of construction are important factors, both in the development of new and improved parts, as well as the extension of their use.

Whether the choice be a casting or forging is in many cases a matter of personal opinion. Of course, many engineers are steel minded, and the choice of a casting would be furthest from their consideration, but it is true that stresses, methods of fabrication, possible changes in design, and equipment often favour castings for many parts.

FIG. 3.—FLAME-HARDENED ARMASTEEL CAM, SHOWING COARSE MARTENSITE STRUCTURE WHICH OFFERS POOR RESISTANCE TO WEAR. (× 500.)

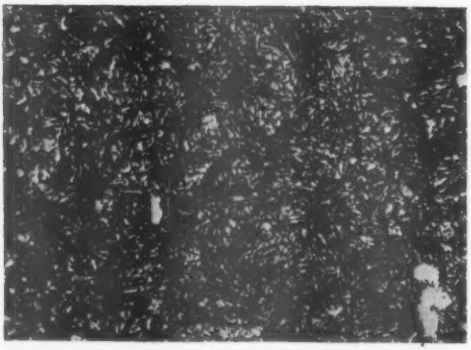


FIG. 4.—FLAME-HARDENED ARMASTEEL CAM, SHOWING FINE MARTENSITE STRUCTURE, WHICH OFFERS MAXIMUM RESISTANCE TO WEAR. (× 500.)

FIG. 5.—FLAME-HARDENED ARMASTEEL CAM, SHOWING EXTREMELY FINE MARTENSITE STRUCTURE, WHICH OFFERS MAXIMUM RESISTANCE TO WEAR. (× 500.)

FIG. 6. FIG. 7.

FIG. 6.—10 PER CENT. SI PIG-IRON, SHOWING STEADITE, GAVE POORLY ANNEALED CASTINGS.
FIG. 7.—10 PER CENT. SI PIG-IRON, FREE OF STEADITE, GAVE GOOD ANNEALED CASTINGS.
(BOTH ETCHED, × 100.)

ArmaSteel—Its Manufacture, etc.

ArmaSteel

A versatile metal, known to the industry as ArmaSteel, which in some cases is referred to as a graphitic steel, since the matrix closely resembles that of a spheroidised steel, dates in its development back some twenty years. The earlier researches were given practically no encouragement by engineers, and it has only been during the past five years that any real progress has been made in production of the product.

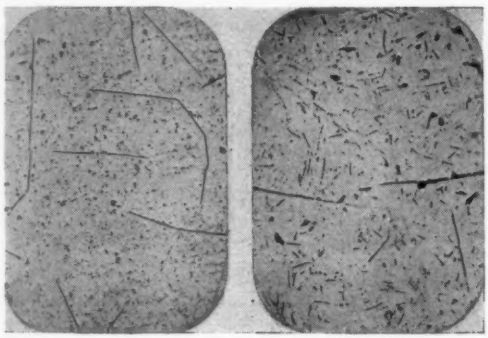


FIG. 8. FIG. 9.

FIGS. 8 AND 9.—10 PER CENT. SI PIG-IRON, UNETCHED, × 100. SHOWING SMALL GRAPHITE FLAKES IN FIG. 8, AND MEDIUM GRAPHITE FLAKES IN FIG. 9.

Chemical and Physical Properties.—This product is made from white cast iron of the following average composition: C, 2.65; Si, 1.35; Mn, 0.40; S, 0.13; and P, 0.05 per cent. The metal is melted in a cupola and refined and superheated in an electric arc furnace. Very close chemical control is followed through on all the raw materials and finished product. Rigid metallurgical control is maintained on all operations. The combined carbon in the matrix gives to the metal properties which compare favourably with those of forgings in the 1,035-1,050 range.

Manufacturing Process.—The heat-treatment of the white-iron casting is one of the most important operations in the production of ArmaSteel. The surface structure of the casting must be free from decarburisation; therefore, close control of the furnace atmosphere is necessary. A number of radiant tube furnaces fired with natural gas are used for heat-treating. Fig. 1 shows one of these continuous roller rail type radiant tube furnaces. The castings are brought up to 954 deg. C. and held for the required time to remove all massive carbide, which is around 15 hrs. The castings are cooled to 870 deg. C. and air or oil quenched. This is followed by a tempering treatment to improve machinability and control physical properties. The time and temperature vary with the design of the casting and Brinell hardness requirements. A tempering temperature of 675 deg. C. for 4 to 6 hrs. will produce castings of approximately 197 to 241 Brinell, and for 6 to 8 hrs. 163 to 207 Brinell hardness. Fig. 2 shows two of the

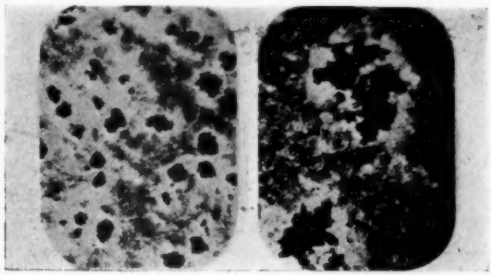


FIG. 10. FIG. 11.

FIGS. 10 AND 11.—ARMASTEEL, 4 PER CENT. NITAL ETCH. × 100, SHOWING EFFECT OF SMALL-FLAKE (FIG. 10) AND MEDIUM-FLAKE (FIG. 11) GRAPHITE PIG-IRON USED IN PRODUCTION.

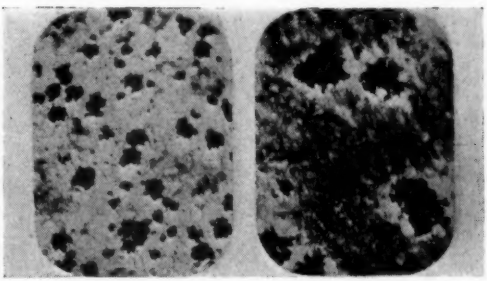


FIG. 12. FIG. 13.

FIGS. 12 AND 13.—ARMASTEEL, 4 PER CENT. NITAL ETCH. × 100, SHOWING EFFECT OF SMALL-FLAKE (FIG. 12) AND MEDIUM-FLAKE (FIG. 13) GRAPHITE PIG-IRON USED IN PRODUCTION.

recirculating temporary furnaces used in malleablising ArmaSteel.

Control of Product

The practical approach to the control of uniformity of the product must be based upon adequate statistical information regarding the product itself and the variables of its manufacture. To this end more or less elaborate statistical systems are employed to record melting and raw material variation and correlate these factors with quality and uniformity. By a study of the records, the metallurgical practice in the plant will fall into a narrower groove of smaller deviations, with the ultimate result of lower rejections and higher quality.

The Metallurgist's Utopia.—The metallurgist's Utopia is a run of metal, producing parts with uniform properties, which will always respond to the same heat - treatment, machining, hardening and wear qualities, showing normal behaviour and no rejections. In the same Utopia it will be necessary to have definitely uniform raw materials. The supply of the latter is becoming more difficult, since specialisation is placing a constantly growing burden upon blast furnaces, coke ovens and steel manufacturers.

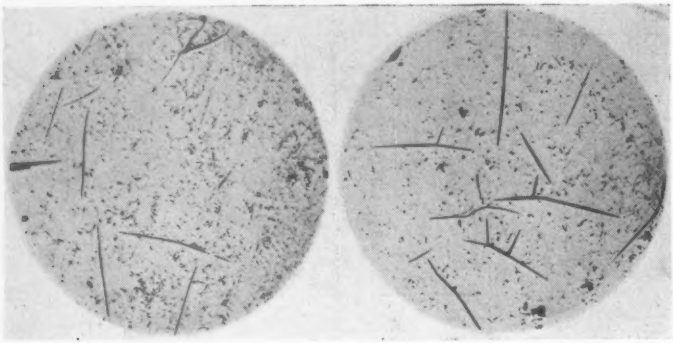


FIG. 14. FIG. 15.

FIGS. 14 AND 15.—10 PER CENT. SI PIG-IRON, UNETCHED, × 100, BOTH COMPLETELY COOLED BY WATER SPRAY. SECTIONS OF PIG-IRON FROM FIRST PORTION OF CAST (FIG. 14) AND LAST PORTION OF CAST (FIG. 15).

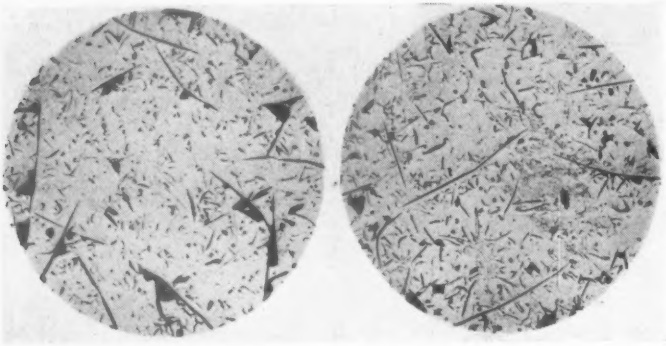


FIG. 16. FIG. 17.

FIGS. 16 AND 17.—10 PER CENT. SI PIG-IRON, UNETCHED, × 100, SHOWING SECTION OF PIG-IRON FROM MIDDLE PORTION OF CAST WHEN ONLY HALF WAY THROUGH COOLING SPRAY IN FIG. 16 AND WHEN AIR COOLED IN FIG. 17.

Manufacturing Process

Specifications and Tests.—The application of ArmaSteel in the motor vehicle and allied industries is mainly in the replacement of drop forged steel parts, such as crankshafts, camshafts, rocker arms, shifter yokes, gears, etc. The metallurgist pins down the steelworks to very exacting specifications as to the steel used for these parts. To mention a few of these tests: chemical analysis, grain size, slag inclusion, abnormality, hardenability, machinability, and others. These factors are primarily controlled in the melting of the steel at the steelworks and require highly skilled technical help.

The foundry industry is following the steel industry in employing increasing numbers of technical men. This is bound to reflect in development of new products, and should be productive of some remarkable results in the not too distant

Arma-Steel—Its Manufacture, etc.

future. ArmaSteel responds to heat-treatment very similarly to steel; therefore, it is only reasonable to believe that this new metal will be subjected to numerous tests and specifications, as its use is further extended.

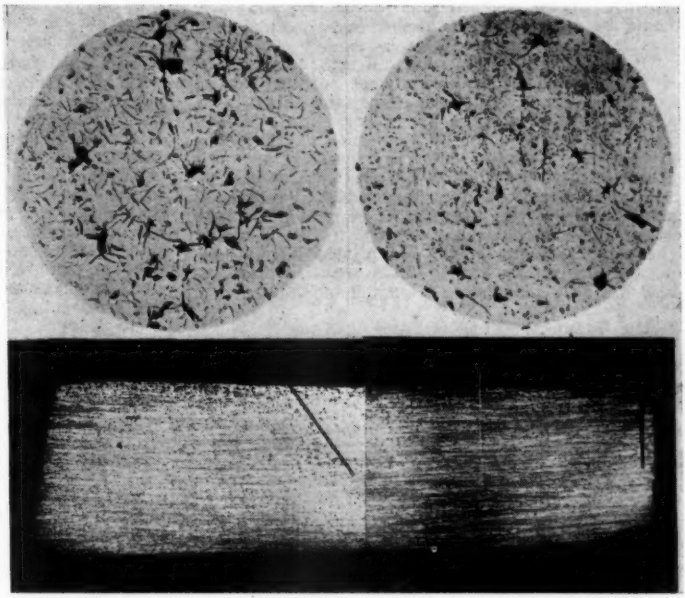
The engineer and foundryman are obliged to compromise on a particular composition and heat-treatment of metal that will give a certain hardness and will have the maximum strength, together with adequate machinability for the particular job. The machinability of the metal depends upon the metallographic structure, which is influenced to a marked degree by the solidification rate of the metal and cooling rate thereafter.

Grinding v. Machining

The development of the art of grinding, in partial replacement of machining, opened the industrial door to hard Arma-Steel for many applications, which had been closed before for the simple reason that they were too hard to be machined. A good example is the flame-hardened ArmaSteel camshaft of to-day. The hardened cams are rough and finish ground instead of rough machined as in the past.

An interesting sidelight on the flame-hardening cam structure reveals that temperature control of the surface to be hardened is extremely important. Wear tests on cams of the same Rockwell "C" hardness reveals that the finest grain structure shows the minimum wear; it is, therefore, desirable to obtain the finest structure possible, which is accomplished by heating to the lowest temperature necessary to produce the depth desired and degree of hardness. Figs. 3, 4 and 5 show cam microstructures at 500 diameters of a badly worn cam (very coarse) and two cams of no wear. The latter shows an extremely fine martensitic structure, which gives maximum resistance to wear, erosion and abrasion.

(To be continued.)



FIGS. 18, 19 AND 20.—10 PER CENT. Si PIG-IRON, CAST IN COPPER MOULD, NO LIME WASH, SHOWING STRUCTURE AT CENTRE OF PIG (TOP LEFT) AND NEAR BOTTOM SURFACE (TOP RIGHT), BOTH UNETCHED, × 100. FIG. 20 (BELOW), UNETCHED, × 3, SHOWS SURFACE FINE GROUND BUT NOT POLISHED.

INDUSTRIAL CONTROL IN FRANCE

Propaganda in favour of the introduction of a quasi-authoritarian control of industry in France is appearing in many French trade and technical journals. "Usine," one of the leading industrial journals in France, has published many articles on this theme. One of these calls attention to the bad state of non-ferrous metal supplies in France; there are ample supplies of only lead and zinc, but for all other metals the country is dependent on foreign sources. The position is aggravated by the prohibition which has been imposed on the importation of copper, tin and nickel, so that industry is thrown back on any stocks which it might have. No alleviation of the situation is possible without the strictest centralised control of existing supplies and the use of substitutes wherever possible. The serious shortages of raw materials is made the basis of a second article for analysing the organisation of the central bureaux controlling the distribution of available materials, the closing of redundant works, and the organised employment of the remainder.

E

PRODUCTION OF UNIFORM STEEL FOR A LIGHT-CASTINGS FOUNDRY

In reply to Mr. W. H. Salmon's written contribution (see FOUNDRY TRADE JOURNAL for August 6) to their Paper of the above title, which was presented at the recent annual conference of the Institute of British Foundrymen, the authors, C. H. Kain and L. W. Sanders, make the following reply:—

"In answer to Mr. Salmon, delays due to the causes he mentions very rarely occur. If in Mr. Salmon's works they do occur frequently, allowance should be made for them in the time-cycle and then steps taken to eliminate them.

"It cannot be agreed that different compositions of steel should cause difficulty in working to an accelerated time-table. The important thing is to lay down the programme some time ahead. Allowance must be made for variables such as alterations in customer's requirements or specification (past records suggest the amount of allowance necessary), the weight required in each mould, core making, moulding and drying delays. There should then be no serious difficulty in working to an Utopian schedule. Since the Paper was printed it has been necessary to increase output still further and the time-table has been modified as is set out in Table A.

TABLE A.—*Tapping Times (Revised).*

Electric Furnaces.		Tropenas Converter.	
"A."	"B."		
2 a.m.	11 p.m.	11.0 a.m.	Soft.
—	3 a.m.	11.30 a.m.	Soft.
6 a.m.	—	12.00 a.m.	Soft.
—	7 a.m.	12.45 p.m.	Hard.
10 a.m.	—	1.30 p.m.	Hard.
—	—	2.15 p.m.	Hard.
2 p.m.	—	2.45 p.m.	Soft.
—	—	3.15 p.m.	Soft.
6 p.m.	—	4.0 p.m.	Hard.
—	—	4.45 p.m.	Hard.
10 p.m.	—	5.15 p.m.	Soft.
—	—	5.45 p.m.	Soft.

"This has necessitated a revised moulding programme to provide 6,100 to 6,200 moulds per week, and a revised pouring schedule to accommodate 12 to 16 converter heats per day instead of 8, and 6 electric heats per night instead of 3. This has resulted in a very high output per man-hour and per square foot of area. It is desired to emphasise that the limiting factors in attaining high output are (1) mould producing capacity, (2) melting capacity. All other operations and factors are merely subsidiary to these two.

"The aluminium additions to the steels quoted were for 'killing' and finishing only and were at the rate of 1½ lbs. Al per ton of steel. Mr. Salmon's suggestion of a critical amount of Al agrees with the authors' experience. No data on this phenomenon or on impact values were given in the Paper as it is proposed to make this the subject of a separate publication.

"In general the authors are in full agreement with Mr. Salmon's remarks regarding the effect of inclusions on fluidity."

BOOK REVIEW

Dog in the Manger. By N. H. Bacon. Published from the "Advertiser" Office, Rotherham. Price 7s. 6d. net.

This little book—it runs to 170 pages—develops a very interesting argument for the elimination of unemployment under democratic conditions. There is no intention on the part of the reviewer to enter into any controversy on the subject, for he believes that a technical journal is not the place for such discussions. The reason why this book is brought to the notice of the foundry public is because the author is "one of us"—that is, he is engaged as a metallurgist in one of the large Sheffield works. The only criticism to be made is that from personal experience the price of beer does not appear to be standardised, and varying amounts are still purchased for one shilling. Moreover, beer itself is not standardised as to flavour! The book itself is well written, though in a number of cases; one argument from the general to the particular would suffice. To those interested—and who is not?—in post-war reconstruction they will find much of absorbing interest in this book.

SILVER IN AIRCRAFT ALLOYS

Because of their high physical properties the "Iron Age" believes it likely that applications will be found in the aircraft field for new light weight silver-rich magnesium alloys. Data furnished by the American Silver Producers' Research Project on a magnesium alloy containing 5.5 per cent. silver, 2.6 per cent. each of aluminium and zinc and 0.2 per cent. manganese indicate this possibility. The new alloy in extruded bars, rolled sections and large forgings, properly heat-treated, has a tensile strength of 17.8 to 29.0 tons per sq. in.; the yield strength is 14.2 to 22.3 tons per sq. in.; the elongation 2 to 10 per cent.; and the Brinell hardness 80 to 95. The specific gravity is only 1.89. The corrosion resistance is comparable to all except the most corrosion resistant of commercial magnesium alloys.

Feldspar as a Fire Extinguisher.—The U.S. Geological Survey has found that finely ground feldspar is effective against incendiary bombs. Tests have shown that when a magnesium bomb was ignited and placed on a pine board and covered with ground feldspar, the fire was extinguished so quickly that the wood was charred only to the depth of ½ in.

DIAGNOSING A CYLINDER COVER CASTING

III.—PRODUCTION IN MEEHANITE METAL

by J. KING

Third contribution on the East Anglian Specimen Casting. Previous talks were reported in issues of July 23 and August 13

Before coming to the main theme of his talk, the author referred to Dr. H. W. Gillett's Paper on "Foundry Teamwork," recently delivered as the Fifth Edward Williams' Lecture. It is an unusual Paper, and if only its recommendations were more widely carried out, the foundry industry would experience considerable benefit. It is pleasing to be able to contribute to the discussions centring around the "specimen casting," because the interchange of views resulting from different members describing how they would solve the problems it raises does, to some extent, represent the manifestation of the team spirit so ably explained and advocated by Dr. Gillett.

Preliminary Considerations

Upon receiving the drawing and model of the cylinder cover to be made in Meehanite, the first points for consideration were:—(1) The function of the casting; (2) what surfaces had to be machined; (3) the pressures it was required to withstand; (4) which was the most important part of it; and (5) at what point or points could trouble be expected to occur? Bearing all these points in mind, the model and drawings received careful study, as a result of which it was decided to make two castings in order to test out the theories formed. (The drawing of the specimen casting appeared in the issue of July 23, p. 287.)

Valve and Jacket Cores

It appeared certain that the critical point of the casting would be somewhere in the metal sections surrounding the valve and jacket cores, more especially, perhaps, at the section between the apex formed by the two inclined cores forming the valve pockets. For the two castings two sets of cores were made from an oil-sand mixture, but one set had incorporated in it 12 per cent. of cast-iron borings, whilst the other was constructed simply of silica sand and oil binder. The borings were passed through an $\frac{1}{8}$-in. mesh sieve before mixing into the sand.

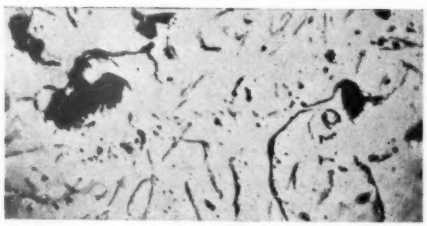


FIG. 1.—PHOTOMICROGRAPH SHOWING GRAPHITE STRUCTURE AND POROSITY. UNETCHED (60 DIAM.).

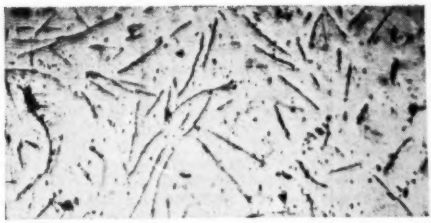


FIG. 2.—PHOTOMICROGRAPH SHOWING GRAPHITE STRUCTURE AND LACK OF ANY LARGE-SCALE POROSITY. UNETCHED (60 DIAM.).

Figs. 1 & 2—Specimens were cut from centre of casting where metal is almost completely surrounded by sand cores which slow the rate of cooling of the metal. In each case the specimen was taken from the apex between the valve cores A & B and abutting on to densener E. Fig. 1 illustrates the unetched structure from a defective casting which leaked under hydraulic test. Fig. 2 is representative of the same section cast in Meehanite metal by the method suggested by the author.

Preliminary tests were conducted on these two sands by casting two bushes having the core in one of the plain oil sand, whilst that in the other was made from the sand in which the borings had been mixed. The bush having the all oil-sand core gave a Brinell reading of 227, whilst the other gave a value of 245.

Diagnosing a Cylinder Cover Casting—III

Mould Runners and Risers

Despite the fact that the spigot or jointing surface was important and had to machine up free from blemish, it was decided to cast it uppermost and have a spray of three ingates at the top edge. By this means it was thought that the valve seats and pockets would more likely be sound and that shrinkage and segregation of metal would take place to a less marked degree. An identical spray of openings was cut on the opposite side of the mould leading to the risers. Runners and risers arranged in this way ensured getting the hottest metal at the uppermost part of the casting, thereby facilitating progressive solidification.

When coring up, the jacket core was placed in first and located by the four prints at the corner bolt holes at both top and bottom of the casting. The valve and valve pocket cores were then placed in their correct positions. Adequate pressure from the ferrostatic head is an important feature of the successful running of castings of this type, where resistance to internal pressure is required. Here it was provided by a height of 11½ in. from the top of the casting to the top of the runner basin. Both castings were poured hot, the time taken to fill the mould was 16 secs.

Metal Used

The metal used was Grade C Meehanite, containing 40 per cent. steel scrap and of chemical analysis as given in Table I. Fig. 2 is the unetched photograph of a specimen taken from the Meehanite casting at the apex of metal section formed between the two valve pocket cores A and B. It shows that the structure is sound and free from large scale porosity. Fig. 1 represents a specimen from the same area of a defective casting (not Meehanite), and the porosity resulting from shrinkage is evident. Here no precautions were taken to guard against the expected porosity.

TABLE I.—*Composition and Properties of Metals Shown in Figs. 1 and 2.*

Fig.	C	Si	Mn	P	Material.
1	3.22	1.57	0.74	0.48	Cast iron.
2	3.11	1.64	1.07	0.16	Meehanite C.

Physical Tests—Fig. 2 only.

Transverse strength: 2,920 lb. on 1.2-in. diam. bar, 18-in. span.

Tensile strength: 18.2 tons per sq. in. on a bar machined to 0.564-in. diam. from a 1.2-in. bar.

Quantity Production

If it was necessary to make this casting in large quantities, the same principle would be carried out as already described. Some slight modification to the pattern would be necessary to facilitate machine moulding. Mr. Slater has dealt with the subject from this aspect and is to be congratulated on the way in which he handled it. Indeed, the co-operation shown amongst the members of the different foundries who have taken part in these discussions is worthy of praise. They have given freely of their time and experience. Mutual assistance of this kind is a big step forward. It is far better than the closely guarded secrecy met with in the past and augers well for the future of the industry.

THERMAL EFFICIENCY OF INDUSTRIAL FURNACES

In Report No. 299 of the heat economy bureau of the Verein deutscher Eisenhüttenleute, reprinted in "Stahl und Eisen" of February 19, 1942, H. SCHWIEDESSEN considers various aspects of the reduction of the heat losses in industrial heat-consuming plants on the basis of the heat utilisation or efficiency ratio, this being the ratio of the heat energy of a fuel which is usefully employed to the total heat generated by the fuel on combustion. It is usually assumed that by reducing heat losses it is possible to cut the fuel consumption of most furnaces in the metallurgical industries by 10 to 15 per cent. and in the fabricating industries by 30 to 40 per cent. By calculating the efficiency ratio for furnace units and comparing the results obtained, the author suggests that pointers can be obtained as to the directions in which improvements in thermal efficiency are possible. Improvements can be achieved by the provision of large and efficient heating surfaces to take up the useful heat, thorough insulation of all parts of the plant where losses may occur, making the ratio of the area of the useful-heat surfaces to the area of the heat-dissipating surfaces as large as possible, and by burning the fuel with the correct proportions of air or gas.

One example of improved heat utilisation, cited by the author, is the blast furnace. When smelting low-grade German ores, coke consumption is found to rise from about 900 kgs. per ton of pig-iron to 1,800 kgs. per ton, in spite of a high utilisation efficiency of the intrinsic heat in the coke. This increase in coke consumption means that production of pig-iron is reduced by half, since throughput is proportional to the tonnage of coke charged. Suitable preparation of the burden, by roasting, sintering and lime burning, enables the coke consumption to be reduced to between 1,300 and 1,350 kgs. per ton of pig-iron, when smelting these ores. In this case, economies have been achieved by suitably modifying the charge handled.

SOUTH AFRICAN CUPOLA PRACTICE

Cupola Linings for White Iron—Water-Cooled Linings—Ganister and Fireclay—Blast Conditions —Tapping Holes—Fuel Consumption

The April meeting of the South African Branch of the Institute of British Foundrymen was devoted mainly to a discussion on South African foundries with special reference to cupola practice.

In opening the proceedings, the BRANCH-PRESIDENT (Mr. J. Tonge) said there were many different opinions as to the most suitable sizes of cupola, the best designs, etc. Such considerations as area, location and the angle and number of tuyeres were among the various factors which had a bearing on the successful operation of the ordinary foundry cupola.

Cupola Linings for White Iron

MR. WARD suggested that a good starting point for the discussion would be the question of refractories. He wished to make it clear that he was referring entirely to white iron melting. He recalled his experience of running a cupola with a 9-in. brick lining and trying to make up the brickwork every evening. This proved impossible with a single cupola, for during the next day's operations they would find the cupola red-hot and the inner lining of brick gone. His experience was that for seven or eight hours' continuous melting, using a fairly high percentage of steel scrap, a 9-in. lining was very often not thick enough, and on many occasions they had gone through 5 in. or 6 in. in a heat. He believed that this experience was not unusual under similar conditions. Mr. Holdsworth suggested that ganister should be tried. This was done and proved successful. He (Mr. Ward) thought that ganister had not yet been used in South Africa to any great extent. It had great advantages in the days when they had only been running one cupola which could serve the floor, with another of only 24 in. diameter which was regarded as a reserve. They had to try to rebrick their cupola every night, which was a very difficult proceeding. With a ganister lining this could be done in half the time and with less expense, and even when they had to put the fire in with a wet ganister lining they succeeded. They had since increased their melting equipment to two cupolas used alternately and lined by day. They used ganister and fireclay mixed. They were putting in a 6-in. thickness every day, and going through that. The chief advantage of ganister was that it reduced the expense of relining, and since using this material they had never experienced any trouble with a red shell. At present they were using about three tons of fireclay to a ton of ganister, and the consumption of ganister and fireclay combined was 0.404 tons* per ton of material melted. The results had been consistently good. They had tried various brands of ganister, some of which gave better results than others. He would like to hear if any other members had any experience of ganister as compared with fireclay. Those using grey iron were not up against it to the same extent. He did not think that the operation of the cupola was at fault, but believed that the material they were handling was particularly severe on linings.

* We suspect this figure should read 0.0404 tons or 90 lbs. per ton. Editor.

Ganister

The BRANCH-PRESIDENT thanked Mr. Ward for discussing the cupola from the refractory point of view. Great Britain was very fortunate in having a well-known quality of ganister, which had made its name many years ago. Here in South Africa the word "ganister" was seldom heard. On several occasions he had referred to the ingenuity shown by South African foundrymen and engineers in making the best of the materials available. It was at Vereeniging that he had seen the nearest approach to British ganister, which suggested to him that it was possible to make the fireclay in this country resemble the old-fashioned ganister, which was more serviceable than brick itself. Then, given a satisfactory refractory, he could see no reason for any foundry to have a shell show red. A 6-in. lining of brick and daubing should last many years.

MR. WARD said that the ganister he referred to was a local material.

MR. BULLOCK asked why it was that he had never seen a cupola which had insulating bricks between the lining and the shell.

The BRANCH-PRESIDENT said that he personally would favour a material between the brick and the shell.

Water-Cooled Linings

MR. WARD was struck by the point that even after a prolonged heat, provided the lining did not get too low, heat could be kept in a cupola practically anywhere. At various times water-cooled cupolas had been tried out, the idea being to keep the bricks cooler.

The BRANCH-PRESIDENT said that his own experience was to put a slight shoulder where the greatest heat was generated, in order to thicken up the lining and prevent any falling down of pig-iron and scrap.

MR. HOLDSWORTH asked whether such a shoulder would not tend to cause scaffolding at the early stages.

MR. TONGE agreed that a scaffold might be formed if the cupola was not charged intelligently.

MR. WARD said that he had worked on the opposite theory. After the day's blow the cupola shaped itself to its own convenience. His theory was that the best results would be obtained by bricking the furnace along the same line.

MR. DYER told the meeting that two years previously he had a similar experience to that of Mr. Ward in regard to red shells. He got in touch with a local factory, which sent a sample of cupola bricks. These lasted quite well. Subsequently he was watching bricklayers reline an electric furnace and noticed that they kept the bricks right back against the shell and

South African Cupola Practice

used as little fireclay as possible. He tried this out himself, and the bricks lasted four or five months. He found that if the bricks were knocked right against the shell and hammered together with only one-sixteenth of an inch joints they lasted twice as long. He also considered that the melting zone would form its own shape.

The BRANCH-PRESIDENT agreed that the ideal was to have as small a joint as possible, particularly with furnaces. An interesting point suggested by the discussion was: What causes bricks laid parallel at the melting point to burn away?

Ganister and Fireclay

Discussing the comparative merits of ganister and fireclay, MR. HOLDSWORTH said that the only reason for using fireclay was to impart adhesive qualities to the ganister. When bricking a furnace it was practically impossible to get a tight joint. If the bricks were pressed far more damage might be caused in the first two or three blows than if they were left an inch apart, because of the expansion which took place. In his opinion the less fireclay used in bricking a furnace, the better.

Discussing the difference between ganister and fireclay, it was agreed that both materials contained the same ingredients, but in different proportions. Ganister contained 90 per cent. of silica as against 60 per cent. in the case of fireclay. The Branch-President considered that good fireclay blocks with a ganister daubing would give the most satisfactory results for lining a furnace.

MR. PETERSEN wondered whether any member present had experience of bigger bricks than ordinary bricks being used. From the discussion it struck him, as an engineer, that it might be possible to get better results with larger bricks because there would be fewer joints.

Monolithic Linings

The BRANCH-PRESIDENT agreed that this was an interesting point. The only objection was that if a brick fell out a larger one was needed to replace it. He knew that larger bricks were being tried out in various places, and referred to the monolithic linings which had been used in recent years with considerable success.

MR. HOLDSWORTH wondered whether any member had experience of the comparative merits of pressed bricks and hand bricks. MR. BULLOCK said that in some furnaces fired with oil and hydrogen both pressed and hand-moulded bricks had been used. The first difficulty was to get a very thin joint with the hand-moulded bricks. After a furnace had been running a couple of months the hand-moulded bricks began to cave in. Difficulty had also been experienced with large bricks from overseas, which were so badly shaped that in places the joints would be half-inch open. The bricks were therefore cut into about three different sections.

Blast Conditions

The BRANCH-PRESIDENT asked whether pressure was more important than volume, or *vice versa*—unless, of course, there was automatic control, which was approaching a balanced blast.

MR. WARD suggested that it was a case of striking a happy medium. Pressure was required to get reasonable penetration and volume to produce the heat. He believed there had been a lot of prejudice against fans, but now fans were coming into favour. A point in connection with blast was the tuyere arrangement. He himself was very much in favour of a single run of tuyeres, with plenty of them and of good size. As regards the entry of blast into the wind-belt, he favoured tangential entry. In the matter of blast control, he was in favour of some positive form of meter. In reply to the Branch-President, MR. WARD added that he had experience both of one row of tuyeres and of "staggered" tuyeres, and found the former easier from a maintenance point of view, while it also narrowed down the melting zone by letting the air in to one zone instead of two.

A MEMBER suggested that staggered tuyeres might give the effect of preheating before the melting zone was reached. MR. WARD'S view was that wherever the tuyeres were located, the same amount of heat would be obtained for a unit volume of air, and the heat would find its way up the stack, giving the same preheating in either case.

MR. HOLDSWORTH considered that two rows of tuyeres would deepen the melting zone. He was in favour of one row of tuyeres. MR. BULLOCK, on the other hand, was of opinion that with a single row a considerable quantity of carbon that should be giving up heat was going up the chimney.

The BRANCH-PRESIDENT pointed out that where a lot of flame was coming out of the chimney door, the remedy was to put the door another three feet higher.

A MEMBER said that all the factors mentioned were important if considered according to their due proportions. To obtain these proportions it was sometimes necessary to have two rows of tuyeres.

Tapping Holes

MR. HOLDSWORTH described a tapping hole which differed from the usual type. The furnaces are lined to give an internal diameter of approximately 40 in., the lining at the hearth being about 10 in. thick. The clay bott is approximately 9 in. long, about 4 in. at the base, and tapers to a point. It is fixed on to 3-in. diameter discs on the bott stick. Practice enables the furnace attendant to get the size remarkably accurate. Since an average of 30 to 40 tons is melted daily, the tap hole has to be good in order to withstand that amount of metal running through and the constant tapping and stopping. The majority of the company's products are white iron, which has a very quick freezing range, and the quicker the metal can be transferred from furnace to ladle the better. The average time taken to tap 25 cwt., from striking the bott to stopping up, is approximately 30 secs. Sometimes with this type of metal, the metal is frozen behind the first stop and has to be removed. A bar and 7-lb. hammer give the necessary persuasion, and it is here that the taper inside proves helpful, as the metal can be pushed inside without much damage to the hole. It will also be realised that with 25 cwt. of metal inside,

(*Continued on page* 376.)

WORLD MINERALS AND THE ATLANTIC CHARTER

At the opening of the recent two-day conference on Mineral Resources and the Atlantic Charter, organised by the British Association, Sir Richard Gregory, President of the Association, who was in the chair, said that the object of the conference was to present certain aspects of minerals and metals from scientific, industrial, and economic points of view for consideration in the post-war international policy contemplated in the fourth clause of the Atlantic Charter.

SIR THOMAS HOLLAND, in an address on "Mineral Resources and the Atlantic Charter," said that petroleum could be made to an increasing extent from the abundant brown-coal supplies in Germany itself, although this incurred the absorption of much technical man-power, and nearly sufficient natural supplies were obtainable from other controlled countries, especially Rumania.

Regarding manganese, which was a "key" product, the chief steel-making countries—the United States, Great Britain, Germany, France, Italy, and Japan—had little more than negligible resources of manganese ore to rely on within their own political boundaries, while the countries in which the mineral occurred in greatest abundance were but small consumers of it. Russia, however, was an outstanding exception. For many years she had been the world's chief producer of manganese, and, unexpectedly to others, during the decade before 1937 increased her output of steel ten times, thus passing from the sixth to the third position among the steel-making countries. Now we could speculate with some degree of certainty on one important reason why Germany suddenly broke her pact and invaded Russia. It was a prospective shortage of manganese rather than of petroleum which threatened disaster to Germany's munition supplies. Another mineral resource of the Soviet which Germany was anxious to exploit was the relatively rare metal, platinum, which was wanted in fairly large quantities for various war industries as well as for the manufacture of nitrous explosives.

Continuing, Sir Thomas said that, as no nation could ever be self-contained in future for essential mineral raw materials, no nation could contribute its share to the progress of civilisation without the operation of principles such as those outlined in the Atlantic Charter. Unless the question of facilitating the international flow of mineral products was settled quickly at the end of the war by an intelligent understanding among the successful Powers, newly concocted aggressive attempts to enforce control would lead intermittently to further outbreaks of war. Delay for more mature consideration might be very rash.

PROF. D. G. H. BOSWELL drew attention to the increasing shortage of geologists in Britain, pointing out that we should find it deplorable if we could not play our part in the active exploration that post-war conditions would necessitate. We might therefore insist that it would be a good stroke of national policy to begin training geologists without delay. Scientists, especially those not engaged in the war effort, should get to work at once on preliminary compilations relating to the world's resources of essential minerals, but the complete data which was to serve as a guide for post-war planning could be compiled only by an international commission after the war.

LIEUT.-COLONEL COLIN A. CAMPBELL, in a Paper dealing with the sources of nickel, estimated that for nickel required by the world would come from Canada. It would therefore be the duty of the British Empire to see that it was available fairly to all desiring to use it legitimately, and yet to prevent its accumulation for war purposes. We must anticipate the development of a higher standard of living throughout the whole of the Far East, and nickel would be needed for these areas to perhaps an even greater extent than it was to-day in the Western countries.

SIR WILLIAM J. LARKE, K.B.E. (Director of the British Iron and Steel Federation), presiding at a subsequent session, said that in these days of ever-increasing rapidity of transport, under peace conditions it would seem to be possible for all nations to obtain access to the raw materials they required, irrespective of their geographical location, if willing to pay the world price for them. The fourth clause of the Atlantic Charter had an important bearing on future policy in that it was a pledge that no restrictions would be placed on access by all nations to raw materials. That might have a much more important bearing on the future than we at present realised, since in the light of present knowledge the deprivation of certain metals would make a nation almost defenceless against others which could obtain them.

SIR LEWIS LEIGH FERMOR, in a Paper on "The World's Manganese Ore Deposits and the Atlantic Charter," said that it seemed clear that pre-war arrangements were adequate to enable every country fitted by nature for the production of iron and steel to obtain by honest trading and purchase at fair rates in the world's markets the supplies of manganese ore needed. He anticipated that a statistical analysis of other minerals on the basis of pre-war statistics would lead to a similar conclusion. If that proved to be the case, then all that clause four of the Atlantic Charter could mean in respect of minerals was that it was intended to restore pre-war freedom of international trade, breaking down such barriers as existed. It would be necessary, however, to prevent for a period the free passage of minerals and other raw materials of use for armaments to the Axis countries in excess of their requirements for peaceful industrial purposes.

The annual blast-furnace capacity for the United States on January 1 this year was 60,393,980 net tons, according to the Annual Statistical Report for 1941 issued by the American Iron and Steel Institute. A year previous the capacity was rated at 57,609,590 net tons. There are 238 blast furnaces in existence, seven being completed during 1941. Pig-iron production in 1941, including ferro-alloys, totalled 56,686,604 net tons as compared with 47,398,529 tons in 1940. Average production of coke pig-iron per blast furnace day rose from 751.1 tons in 1940 to 774.4 tons for 1942.

SOUTH AFRICAN CUPOLA PRACTICE

(*Continued from page* 374.)

a 4-in. hole requires good sealing. This is obtained because the pressure of metal on the point flattens the metal somewhat and causes a revetting action, spreading the clay and sealing it along the hole. Since the hole is sealed to the front, it is fairly easy to keep clean, thus enabling trouble-free tapping. The hole is about half-inch above the sand bed in the spout and is cleaned before each tap with a chisel-bar. While the majority of casts are in white iron, grey-iron alloys running up to seven tons are also produced. After the usual run of white iron, the men blow down and make up the bed coke, and charge again. No trouble is experienced with the tap hole. Mr. Holdsworth showed the meeting two botts which had been prepared for use.

Fuel Consumption

The BRANCH-PRESIDENT said that Mr. Holdsworth had raised an interesting point regarding the tap hole and he entirely agreed with him when speaking of white iron. In regard to fuel consumption, he maintained that the obvious policy was to use as little fuel as possible, provided that suitable metal could be obtained in the ladle.

A MEMBER said that coke was the cheapest commodity in the foundry and metal the most valuable.

The BRANCH-PRESIDENT agreed that no foundryman worth his salt would attempt to cut down fuel consumption to the extent of affecting the metal. He thought it should be left to the man in charge to determine the size of the coke, provided he obtained a reasonable metal at a reasonable price.

MR. HOLDSWORTH said he had heard that the correct method was to have the coke a uniform size—say, 3 in. or 4 in., and no bigger. He wondered how many foundries did this and what real effect it had on the melting efficiency, compared with the added loss owing to the fines besides that caused by loading into the truck and off-loading into the bin, by the time that the lumps had been broken. Including the labourer's wages and the added fines this loss would be about 10 per cent. He also wondered why so much emphasis was put on the layer of coke and layer of metal. Since the amount of the metal and coke ratio were known, why not put smaller charges with the required amount of coke on top? Would this not tend to give a better mixing?

In reply to Mr. Bullock, the BRANCH-PRESIDENT said that he personally did not favour small pieces of coke. A consistent coke bed determined the success of the day's melt. To start off with a deficient coke bed affected the whole day's melt, and he therefore preferred a good high coke bed.

MR. HOLDSWORTH said that in his experience a height was invariably found which was suitable for the general run. Whether or not another 6 in. was added would make no difference, because the metal would not melt until it reached the melting zone.

The BRANCH-PRESIDENT pointed out that when the level had been found, it was preferable to add 6 in. than to put 6 in. less.

UNITED NATIONS' STEEL NEEDS

U.S. MISSION TO BRITAIN

As briefly reported in our last issue, the Combined Production and Resources Board have appointed an American Steel Mission to Great Britain, in a move to attack this basic war production problem of the two countries on a united basis. The Mission will study British methods and requirements and investigate means of increasing the quantity of steel needed for the United Nations' war effort and of obtaining maximum efficiency in the United States allocation of the combined productive capacity of the two countries. It is hoped that a British Steel Mission will go to the United States to make a similar study there when the American group returns to the United States.

The appointment of the Mission and arrangements for its visit to Britain were completed one week after the Combined Production and Resources Board had held its first formal meeting. Sir Robert Sinclair, deputy for the British Minister of Production, Mr. Oliver Lyttelton, on the Combined Board, arrived in America on July 25. Mr. Donald Nelson, chairman of the War Production Board, is the American member, and Mr. James M. Knowlson, vice-chairman of the War Production Board, is his deputy.

Far-Reaching Study

The Mission will study ways to increase total production of steel in the United States and Britain; the British system for control of steel production, allocation and distribution; how the two nations' steel can be brought into better balance so that plates, sheets, structural steel, etc., will all be produced in the proper ratio; whether increased production and saving of shipping space can be effected by sending more ingot steel and less finished weapons to Britain and *vice versa*; what steel products can best be made in the United States and what can best be made in Britain; which theatres of war should be supplied from Britain and which from the United States in order to save shipping space; methods used by Britain to collect steel scrap and the use made of scrap; British progress in reducing steel consumption by substitution, simplifying specifications and eliminating wasteful machine operations, and means of pooling such information by the two countries; what percentage of British steel production is used for war production and what percentage is essential civilian production; and means of obtaining savings in the use of scarce alloy steels.

Members of the Mission

The members of the Mission are: Mr. Charles R. Hook, of Middleton, Ohio, president of the American Rolling Mill Company (chairman); Mr. Paul F. Schucker (Washington), chief of the Lend-Lease and Import Section, Iron and Steel Branch, War Production Board; Lt.-Col. Paul P. Llewellyn (Washington), Army; Capt. G. A. Duncan, Navy; Mr. Walter S. Tower (New York City), president of the American Iron and Steel Institute; and Mr. Earl C. Smith (Cleveland, Ohio), chief metallurgist to the Republic Steel Corporation.

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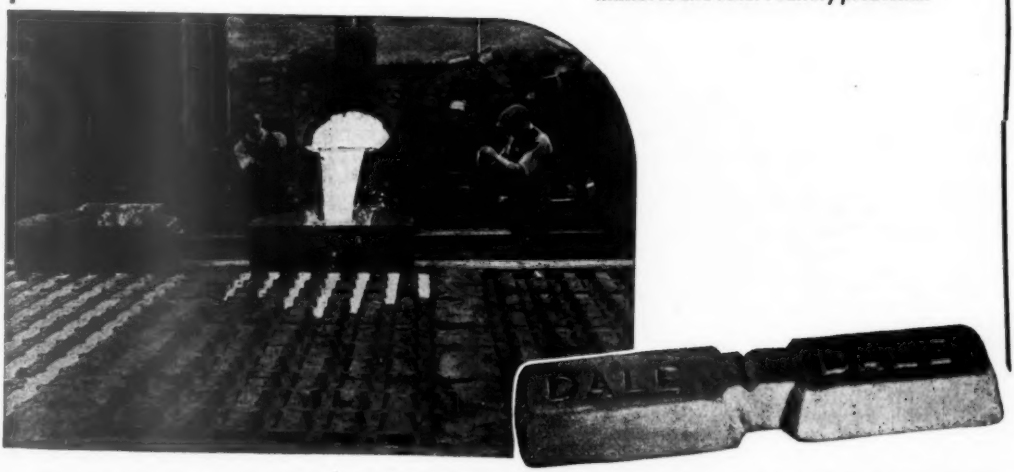
IS CHARACTERISED by closeness of grain structure, uniformity of composition and fine graphitic carbon evenly distributed.

IS PRODUCED to guaranteed analysis in seven standard grades.

CAN BE MADE to customers' individual requirements with total carbon from 2·6 per cent. upwards.

SHOULD BE USED to tone up high phosphorus irons and scrap, to replace Hematite, and to produce castings for all high duty purposes.

Users are invited to avail themselves of the Stanton Technical Service which offers free expert advice on special mixtures and other Foundry problems.



THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

ESSENTIAL WORK ORDER

PAYMENT OF THE GUARANTEED WAGE

As briefly reported in our last issue, the Minister of Labour has made a new Essential Work Order consolidating the existing General Provisions Order, the Amendment Order by which absenteeism and persistent lateness were made direct offences, and the Part-time Workers Exclusion Orders, which excluded from the principal Order part-time workers who had entered industry because of war-time conditions.

In addition to certain minor amendments of an administrative nature, the new Order provides that wages paid for overtime or Sunday work shall be reckoned as if paid for at the ordinary time rate in calculating a worker's wages to determine any payment necessary to make up the guaranteed wage payable under the Order. Another new provision secures that workers are not disentitled to the guaranteed wage in respect of time spent in attending Appeal Board hearings when they appeal successfully against suspension or dismissal for serious misconduct. Also, the existing provision that the guaranteed wage is payable during the interval between dismissal for serious misconduct and reinstatement after successful appeal is now extended so that a worker is not disentitled to the guaranteed wage if he takes temporary employment in the interval. Any sums earned in respect of the temporary employment are to be deducted from the guaranteed wage payable by the original employer. These amendments have been made in agreement with the Joint Consultative Committee of the British Employers' Confederation and the T.U.C.

Copies of the Order, entitled the Essential Work (General Provisions) (No. 2) Order, 1942 (S.R. & O., 1942, No. 1594), can be obtained at H.M. Stationery Office.

OBITUARY

MR. J. B. BANNISTER, manager of the non-ferrous metals department of the Birmingham works of Thos. W. Ward, Limited, died recently, aged 64.

MR. F. F. SHARPE, iron and steel merchant, Lonsdale Chambers, Lichfield Street, Wolverhampton, died suddenly on August 8, aged 74. His executors have decided to continue the business in the absence of Major Kenneth Sharpe, who is on active service.

MR. F. S. TOOBY, who was for many years commercial manager of the Midland branch of Baldwins, Limited, died suddenly on August 5, aged 60. Mr. Tooby entered the employ of E. P. & W. Baldwin, Limited (later absorbed by Baldwins, Limited) at the early age of 13. After some time spent in the works he joined the commercial side of the business. His abilities were soon recognised by Mr. Alfred Baldwin, M.P., and Mr. Tooby was closely associated with Mr. Baldwin until the latter's death, and afterwards with Mr. Stanley Baldwin until the latter severed his business connection with the company to become Financial Secretary to the Treasury. For the past 30 years Mr. Tooby controlled the whole of the buying and selling of the Midland branch of Baldwins, Limited.

NEWS IN BRIEF

NET PROFIT of the International Nickel Company of Canada, Limited, for the six months to June 30 last amounted to $16,008,614, a decrease of $1,306,993 compared with the figure for the corresponding half of 1941.

A FURNACE PIG-IRON LIFTER was fined £15 at Renishaw for absenting himself from work at the Renishaw Ironworks on three days during May. It was stated that he had missed 125 times in a year. His average wages fell from £5 3s. 7d. to £3 15s. 9d.

RAILWAY SHOPMEN, under an award of the Industrial Court, are to receive an increase of 4s. a week in the war wage or bonus, making 16s. a week. The minimum rate, exclusive of war wage or bonus, is to be increased by 4s. 6d. a week for adult male workers, and by 3s. a week for women doing women's work.

MR. BERNARD STAGG, 19, Figtree Lane, Sheffield, 1, is secretary of the Sheffield Supplementary Steel Producers' and Manufacturers' Association, formed to give all possible aid to the war effort and to afford mutual assistance and guidance in dealing with the Ministry of Supply and Iron and Steel Control regulations, and other matters.

THE PARTNERSHIP between Herbert Blackburn, James Foulds and Sidney Foulds, carrying on business as ironfounders at Junction Foundry, Burnley Road, Colne, Lancs, under the style of Thomas Foulds & Company, has been dissolved so far as concerns Herbert Blackburn, who retires. Debts will be received and paid by the remaining partners who will continue to carry on the business.

THE LARGE AMOUNT OF industrial re-lighting made necessary by war conditions has imposed a severe strain on the resources of illuminating engineering firms and there is a serious shortage of experts. It would be of great assistance to the lighting industry and would save many technical man-hours if factory executives would forego their established practice of obtaining numbers of alternative plans for any amendment needed by their lighting installation.

DAVY AND UNITED ENGINEERING COMPANY

Mr. A. C. Macdiarmid (chairman of Stewarts and Lloyds, Limited), Sir Walter Benton Jones (chairman of the United Steel Companies, Limited), and Mr. John E. James (chairman of the Lancashire Steel Corporation, Limited, and vice-chairman of Richard Thomas & Company, Limited) have joined the board of the Davy & United Engineering Company, Limited.

The Davy & United Engineering Company manufactures heavy plant and equipment for the iron and steel industry, and the three new directors are placing their knowledge and experience at the disposal of the company with a view to establishing a closer technical collaboration between the maker and the user of the equipment, and of ensuring a progressive policy of technical development. They are not taking a financial interest in the company.

SEVEN PILLARS OF PROGRESS

4. The basic principles of science rely on independence combined with co-operation, and are influenced by the progressive needs of humanity.

"The Charter of Science"—British Association, 1941.

In the foreword of the brochure describing the Central Research Department of The United Steel Companies Limited originally published in 1934, there occur these words —"It is natural that certain types of development research should be carried out under our personal control and in contact with our own particular production activities. On the other hand, we continue to contribute, both in material and service, to the general pool of knowledge through the various co-ordinating committees of other research bodies, and to link it up with industrial requirements." This is the foundation of modern applied science—individuality of research, co-operation within the framework of the industry, joint exploration with other industries to anticipate their needs and provide for their future requirements. This leads on to co-ordination with the general scientific and industrial development of the whole nation and beyond with that of countries overseas, so that, in the end, humanity as a whole may benefit by these progressive labours.

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United Strip & Bar Mills, Sheffield | The Sheffield Coal Co. Ltd. | Thos. Butlin & Co., Wellingborough

U.S.P. 4

PERSONAL

MR. W. H. PURDIE has been appointed a director of William Doxford & Sons, Limited, shipbuilders and engineers, of Sunderland, in place of the late Mr. K. O. Keller.

SIR W. PETER RYLANDS has presented a convalescent home to Warrington Infirmary, Thelwall Grange, having been converted for this purpose. Sir Peter Rylands is chairman and managing director of Rylands Bros., Limited, wire manufacturers, of Warrington.

MR. W. H. HEATON, after over 30 years as works manager at the Witton engineering works of the General Electric Company, Limited, recently retired from this position, but will continue to serve the company in an advisory and consultative capacity and on special work. Mr. Heaton served his apprenticeship with Laird Bros., of Birkenhead, and joined the staff of the British Westinghouse Company in 1904, becoming assistant superintendent of the engine department at their Trafford Park Works, Manchester. His career with the G.E.C. began in 1912, at a time when the company was largely extending its activities in the field of heavy engineering. Mr. Heaton has always been a strong advocate of the importance of the education and training of the young engineer and took a personal interest in each of the many apprentices in the works. He was chairman of the G.E.C. Engineering Apprenticeship Association for over 20 years, and is chairman of the City of Birmingham and District Certificate of Apprenticeship Committee. He has also played a prominent part in the activities of the Engineering and National Employers' Federation. For over 20 years he has been a member of the Management Board of the Birmingham Association, of which he is a past-president, as well as being a member of the Central Conference and Regional Committee and various technical sub-committees.

Wills

HOGG, JAMES, for many years secretary and a director of the Burntisland Shipbuilding Company, Limited	£9,434
LANG, SIR WILLIAM BIGGART, of Johnstone, Renfrewshire, chairman of John Lang & Sons, Limited, machine-tool manufacturers and engineers ...	£62,090

SCOTTISH REGIONAL PRODUCTION BOARD

The Regional Board for Scotland under the Ministry of Production has been reconstituted on the lines recommended by Sir Walter Citrine's Committee. The members of the Board, in addition to official representatives are: Chairman, Mr. Lewis J. B. Forbes (Regional Controller of Production); vice-chairman, Sir Harold E. Yarrow, Bt., Yarrow & Company, Limited; vice-chairman, Mr. W. Elger, secretary, Scottish T.U.C. General Council; employers' representatives —Mr. William Wallace, Brown Bros. & Company, Limited, Rosebank Ironworks, Edinburgh, Mr. J. B. Lang, John Lang & Sons, Limited, Johnstone; trade union representatives—Mr. J. Young, divisional organiser, Association of Engineering and Shipbuilding Draughtsmen, Mr. D. Forsyth, A.E.U.

COMPANY NEWS

(Figures for previous year in brackets.)

Hadfields—Interim dividend on the ordinary shares of 7½% (same).

Masson Scott & Company—Net profit, £18,937; ordinary dividend of 5% (nil); forward, £3,983.

Manley & Regulus—Net profit, £15,466 (£16,193); final ordinary dividend of 5%, making 10% (same); forward, £31,635 (£23,245).

United Gas Industries—Net profit, £91,897 (£80,448); final dividend on the ordinary shares of 7% (6½%), making 12% (11%), and a dividend of 50% (25%) on the deferred shares.

Amalgamated Metal Corporation—Net profit to March 31, £212,225 (£321,187); dividend on the ordinary capital of 3½% (6%); forward, after preference dividend, £36,026 (£33,054).

Aveling-Barford—Net profit, after charging depreciation, pensions, E.P.T., etc., £69,477 (£74,694); income tax, £38,268 (£41,500); insurance, £3,317 (£4,100); preference dividend, £4,640 (£4,785); ordinary dividend of 10%, tax free (same); forward, £43,520 (£40,270).

Broken Hill Proprietary Company—Net profit from trading, £379,885, plus income from investments of £307,826, making a total of £687,711, after providing £1,025,013 for depreciation, £750,000 income-tax and £550,348 special depreciation of plant, etc. (net profit £963,279).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

William Allen (Machinery), Port Street, Manchester —£10,000. T., F., and P. Tomlinson.

Rosemont Engineering Company, 318, Ballards Lane, London, N.12—£3,000. W. Pilgrim and J. O. Frogley.

Paramount Alloys, 11, Haymarket, London, S.W.1—£100. N. R. Reynolds, H. J. Henbrey and A. S. Poynton.

Eclipse Foundry & Engineering Company (Dudley) —£1,000. W. M. Wright, 200, Wolverhampton Street, Dudley, subscriber.

Tees Side Components—Engineers, toolmakers, etc. £3,000. E. Bunting, 641, Marton Road, Middlesbrough, and J. C. Worrall.

S. Crowther (Royton), Axis Ironworks, Orchard Street, Royton, Lancs—Founders, engineers, etc. £2,000. S. and A. Crowther.

Devonish & Williams—Metal founders, etc. £1,000. E. C. Devonish, 52, Hollywood Way, Woodford Green, Essex; H. D. M. Devonish, A. A. and E. J. Williams.

Harding Manufacturing Company—Engineers, etc. £5,000. E. S. Marsh, 59, Tudor Avenue, Watford; E. W. Smith, J. Blanchard, V. M. Marsh, and H. Cashman.

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Raw Material Markets

IRON AND STEEL

Holidays are still being taken in some sections of the iron and steel industry, so that production during the current month will be under the average levels of recent months. A considerable amount of repair work and renewals is being carried out while the workers are enjoying their well-deserved break and the industry will shortly be ready to embark upon another period of full-out production such as it has experienced since it was placed on a war footing. Despite the unprecedented expansion in the output of steel it is still necessary for the Control authorities to import supplies from the United States, but the quantities involved now represent but a small proportion of the imports in the earlier stages of the war, so that much shipping space has been released for more important cargoes.

Foundry iron is being delivered according to the quantities licensed by the Control. High-phosphorus grades, which are manufactured from ores found in the United Kingdom, are in plentiful supply and users experience no difficulty in procuring all they need. Light-castings makers are not really well engaged except in isolated cases, so that their consumption of high-phosphorus iron is at a reduced level, but quite a considerable tonnage of this grade is being absorbed by the heavy engineers, who are unable to obtain all they ask for in the way of special quality material, such as hematite and refined irons. Owing to the desirability of curtailing imports of the foreign ores needed for the manufacture of special irons, production has been lowered appreciably as compared with pre-war standards, but consumers are not seriously inconvenienced, and with the liberal allocations of high-phosphorus iron, steel scrap, etc., they are able to operate satisfactorily. When the use of hematite is imperative the Control has adequate reserves on which to draw and no priority consumer has so far been left without sufficient of this material.

It had been expected that some adjustment would have been made by now in respect of iron and steel selling prices to counteract the substantial increase recently made in fuel charges, but so far no intimation has been forthcoming from the Control. The Government is averse to higher prices, but it was felt that iron and steel makers were entitled to some compensation, as they had had to bear several increases in costs of production and they were working on rather narrow margins of profit before the new fuel prices were announced.

The demand for special qualities of steel continues to outstrip the supply, despite the extensive developments which have occurred in the production of these grades; but consumers are being well catered for on the whole and their needs receive the most careful attention, as users of these descriptions generally are engaged on the production of armaments and munitions, etc. So insistent is the demand that many works are operating throughout the normal holiday period, stoppages being reported only when repair work is necessary in the interest of future production. Plate mills are briskly employed. Pressure for the lighter descriptions of structural steel is strong, while heavy sizes are also moving quite well.

There is a rather more active tone in the iron and steel scrap market, as consumers are again in operation in many instances after a cessation of work for holidays and repairs, during which time many users of scrap temporarily suspended deliveries. This applies more particularly to the steelworks, which are very large scrap consumers. In some parts of the country better plans for the collection, assembly and preparation of scrap for furnace use have been brought into operation, with the result that deliveries have improved. Special steps have been taken with regard to scrap procured from disused railway sidings and collieries and there is now an abundance of railway scrap and light metal, while the quantity of old metal realised from the shipyards has also been considerably enlarged.

NON-FERROUS METALS

Consumption of copper continues to expand with the coming into operation of additional war factories, which are absorbing the bulk of the metal released by the Control authorities. There seems to be plenty of copper available to meet all essential requirements, but distribution in other directions is very carefully controlled.

Further steps are being taken to reduce the consumption of tin in this country, as, although considerable economies have already been achieved, there is still plenty of opportunity for additional economy. Commercial gunmetal and high-grade brass are in future to replace Admiralty gunmetal where possible, while commercial gunmetal will at times give way to brass. Licences for the acquisition of fresh tonnages of tin are issued sparingly, but supplies are being readily granted to consumers engaged upon urgent war contracts. Across the Atlantic some indication of the steps taken to lower the usage of tin is contained in statistics issued recently by the U.S. Department of Commerce. Deliveries of white base anti-friction bearing metals in January last totalled 2,458 tons, against 1,811 tons in January, 1941; by April deliveries had fallen to 1,568 tons, compared with 2,903 tons in April of last year. It is reported that no serious inroads have yet been made in the U.S. Government's tin stock-pile.

It is understood that American smelters have been requested to set aside a small percentage of their August production of spelter to form the nucleus for a stock-pile. There is little change in the spelter situation in this country, where distribution is very carefully controlled in view of the Government's desire to conserve available supplies for the war effort.

The accumulation of lead supplies by the American Metals Reserve Company continues to be maintained, and it is reported that the objective of 200,000 short tons as a strategic reserve may be attained by the end of September.

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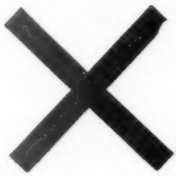

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